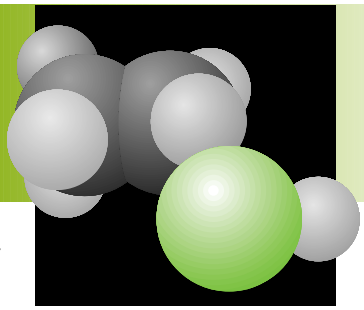
CHEMICALS

Project Fact Sheet



Low-Frequency Sonic Mixing Technology

Benefits

- Potentially saves at least 40 billion kWh in fermentation, hydrogenation, and wastewater treatment markets alone
- Mixing time is reduced up to 62 percent
- Enhances mass transport
- Improves reaction rates on both macro- and micro-mixing levels
- Competitively priced with current mixers in many applications
- Technology works well in many situations, such as heat- or mass-transfer limited systems, those that expend inordinant mixing energy, or those that require mixing uniformity

Applications

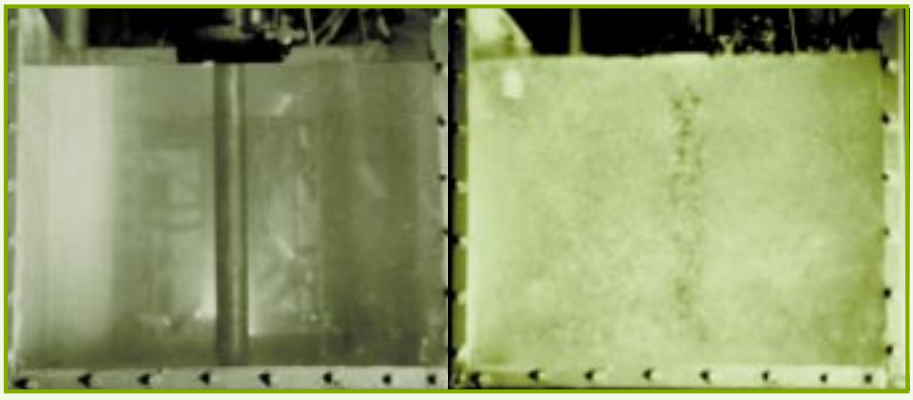
The low-frequency sonic mixer has applications in a number of industries, including but not limited to: agriculture, chemical manufacturing and processing, food, mining, municipal waste treatment, petroleum, pharmaceutical, pulp and paper, and water treatment. Mixer capacity ranges from small, bench-top mixers to large, high-volume industrial mixers. The low-frequency sonic mixer is capable of general mixing functions and is applicable for processes that use fermentors and bioreactors to mix materials that are easily damaged by the shearing caused by a rotating impeller.

An innovative device enhances liquid-gas mixing equipment while in many cases enhancing productivity and saving energy

Typical mixing technology involves the use of a drive mechanism—usually an electric, hydraulic, or pneumatic motor—to rotate a shaft with one or more impellers. While there are other designs of mixers, including static mixers that do not use motors, the motor-driven mixer is the most prevalent mixing method.

A newly developed sonic mixer offers a novel and improved approach to mixing. This mixer does not use an impeller; instead, low-frequency acoustic energy causes vigorous hydraulic motion on both the bulk and the micro scale. The sonic mixer uses an electric or hydraulic motor to power an eccentric drive, which causes bars, pipes, plates, or a combination thereof to resonate. The resonating, or vibrating, bar creates sonic waves that move through the medium, causing mixing to occur. The technology is a highly-efficient method applicable to liquid-liquid, gas-liquid, and liquid-gas-solid mixing, contacting, heat and mass transport.

Sonic Mixer Before and During Mixing



Before Sonic Vibration **During Sonic vibration**

This new low-frequency sonic mixing technology uses acoustic energy rather than impellers to mix gases, liquids, slurries, and combinations thereof. Conversely, impellers must move the bulk of the fluid.

Project Description

Goal: Design, fabricate, and test an industrial-scale prototype, and further quantify capabilities.

Low-frequency sonic processing is a simple use of current sonic technology. The system can be thought of as a resonating "tuning fork" placed into the process stream. This "tuning fork" radiates strong sonic waves into the medium, causing vigorous mixing of gases, liquids, and slurries, both on particle and larger scales simultaneously.

The mixing process itself offers a competitive advantage. The sonic wave action results in a more thorough mixing of materials. This improvement enhances the mixing of some materials by increasing the effectiveness of the catalysts and processes.

Montec Research has developed this new technology with the help of a grant funded by the Inventions and Innovation Program in the Department of Energy's Office of Industrial Technologies.

Progress and Milestones

The low-frequency sonic mixer is an improved application of an existing, patented sonic engine. This application of a sonic engine as a mixer is so substantially different from its original use that there is no significant patent concern. Additional modifications to the resonating member (sonic transducer) and mixing chamber have been dramatic enough that no patent conflict seems apparent. This finding was confirmed through an extensive patent search.

Montec Research of Butte, MT, is simultaneously pursuing several different aspects of development. First, the company is seeking proprietary protection of the low-frequency sonic mixer's processes and apparatus through the U.S. Patent Office.

In addition, the mixer's capabilities are being explored further to quantify mixing propensity, energy savings, and other important features. Montec Research has also entered into negotiations with existing mixing-technology manufacturers, vendors, and users. These discussions are expected to lead to an opportunity to capitalize on the project and to move the subject technology to the market.

Economic and Commercial Potential

The mixer market is between $800 million and $1,200 million annually worldwide. The annual growth rate for the process control industry is 5 to 6 percent, with a sales growth that is double the growth of the GDP. Growth may reach double digits for other markets, such as pharmaceutical and biotech. Moreover, experts within the mixer industry predict that the demand for mixers, especially in the chemical-processing industry, will begin to increase dramatically. Industry forecasts indicate this rise in demand could take place within a year.

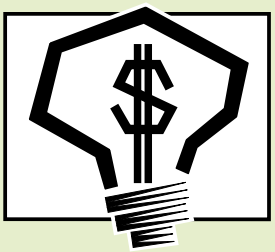
Industries that use mixers in their production process are extremely receptive to new mixing technologies that can help lower their manufacturing costs. The improved efficiency and lower energy costs of the low-frequency sonic mixer make this innovative technology an attractive option for users of industrial mixers.

In addition, many users of mixers, such as chemical and pharmaceutical companies, are actively working to develop mixing methods for producing new products that cannot be manufactured due to the limitations of current mixing technology. The revolutionary aspects of the low-frequency sonic mixer have already raised a significant amount of attention from companies interested in innovative mixing technologies.

Industry of the Future—Chemicals

The chemicals industry is one of several energy- and waste-intensive industries that participate in OIT's Industries of the Future initiative. In December 1996, the chemicals industry published a report entitled ***Technology Vision 2020: The U.S. Chemical Industry*** *that helps establish technical priorities for improving the industry's competitiveness and develops recommendations to strengthen cooperation among industry, government, and academia. It also provides direction for continuous improvement through step-change technology in new chemical science and engineering technology, supply chain management, information systems, and manufacturing and operations.*

OIT Chemicals Industry Team Leader: Paul Scheihing (202) 586-7234.



The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and conduct early development. Ideas that have significant energy savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

Project Partners

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